

1 **Amendment to the Claims**

2 **In the Claims:**

3 Please amend Claims 8, 9, 12, 13, 21, 22, and 23 as follows:

4 1. (Original) A method for controlling an element that is part of a system so that for an
5 instance in which it is necessary to reposition the element, the element is moved between a first
6 position and a second position during a transition-time interval, and so that the element only moves
7 during the transition-time interval and is precisely positioned both immediately before and after the
8 transition-time interval, comprising the steps of:

9 (a) providing a model of the system;

10 (b) using the model for characterizing internal dynamics of the system in which
11 energy applied to the system outside the transition-time interval is hidden so that the element does not
12 move, other than during the transition-time interval;

13 (c) for a selected optimization criterion, determining optimal internal states at a
14 beginning and an end of a movement of the element between the first position and the second
15 position; and

16 (d) based upon the optimal internal states, determining an optimal control input
17 signal for a transition-interval input, and at least one of a pre-actuation input and a post-actuation
18 input acting on the element to cause the element to move from the first position to the second position
19 so as to achieve the selected optimization criterion, wherein the pre-actuation input applies energy to
20 the system before the transition-time interval, the post-actuation input applies energy to the system
21 after the transition-time interval, and the transition-interval input applies energy to the system during
22 the transition-time interval.

23 2. (Original) The method of Claim 1, wherein the selected optimization criterion is to cause
24 the element to move between the first position and the second position with substantially a minimum
25 input energy.

26 3. (Original) The method of Claim 1, wherein the selected optimization criterion is to cause
27 the element to move between the first position and the second position in substantially a minimum
28 transition-time interval.

29 4. (Original) The method of Claim 1, wherein the pre-actuation input is uniquely specified in
30 terms of an unstable internal state component.

1 5. (Original) The method of Claim 4, wherein the post-actuation input is uniquely specified
2 in terms of a stable internal state component, and wherein the unstable internal state component and
3 the stable internal state component are the only components of boundary states for the first position
4 and the second position that can be varied to ensure that the element does not move as a result of the
5 energy applied to the system other than during the transition-time.

6 6. (Original) The method of Claim 1, wherein the control input signal is defined as a
7 function of a transition state difference related to the difference between the first position and the
8 second position.

9 7. (Original) The method of Claim 1, wherein at least one of the pre-actuation input, the
10 post-actuation input, and the transition-interval input comprises a periodically varying signal at one
11 or more frequencies selected to produce a force that acts on the element without causing the element
12 to move prior to or after the transition-time interval.

13 8. (Currently Amended) The method of Claim 1, wherein to move the element during the
14 transition-time interval, further comprising the step of applying ~~an~~ the transition-interval input signal
15 ~~to move the element~~ during the transition-time interval, as well as applying the post-actuation input
16 after the transition-time interval, but not applying the pre-actuation input before the transition-time
17 interval.

18 9. (Currently Amended) The method of Claim 1, wherein to move the element during the
19 transition-time interval, further comprising the step of applying ~~an~~ the transition-interval input signal
20 ~~to move the element~~ during the transition-time interval, as well as applying the pre-actuation input
21 before the transition-time interval, but not applying the post-actuation input after the transition-time
22 interval.

23 10. (Original) The method of Claim 1, wherein the element comprises a read/write head of a
24 nonvolatile memory device that is moved between the first position and the second position to
25 provide access to different portions of a memory medium.

26 11. (Original) The method of Claim 1, wherein the element is included in a nonlinear
27 system.

28 12. (Currently Amended) The method of Claim 1, wherein the element is moved between the
29 first position and the second position to ~~carry out~~ carry out a function, said function comprising one
30 of:

1 (a) scanning a surface;
2 (b) reading data;
3 (c) writing data;
4 (d) positioning the element to implement a process;
5 (e) positioning the element to access a desired material;
6 (f) controlling a process as a function of a position to which the element is moved;
7 (g) fabricating a component by moving the element; and
8 (h) controlling operation of the system in which the element is included, as a
9 function of a position to which the element is moved.

10 13. (Currently Amended) A memory medium storing machine readable instructions for
11 controlling an element that is part of a system so that for an instance in which it is necessary to
12 reposition the element, the element is moved between a first position and a second position during a
13 transition-time interval, and so that the element only moves during the transition-time interval and is
14 precisely positioned both immediately before and after the transition-time interval, the machine
15 readable instructions, when executed by a computing device, carrying out the following steps—of

16 Claim 1:

17 (a) accessing a model of the system;
18 (b) using the model for characterizing internal dynamics of the system in which
19 energy applied to the system outside the transition-time interval is hidden so that the element does not
20 move, other than during the transition-time interval;

21 (c) for a selected optimization criterion, determining optimal internal states at a
22 beginning and an end of a movement of the element between the first position and the second
23 position; and

24 (d) based upon the optimal internal states, determining an optimal control input
25 signal for a transition-interval input, and at least one of a pre-actuation input and a post-actuation
26 input acting on the element to cause the element to move from the first position to the second position
27 so as to achieve the selected optimization criterion, wherein the pre-actuation input applies energy to
28 the system before the transition-time interval, the post-actuation input applies energy to the system
29 after the transition-time interval, and the transition-interval input applies energy to the system during
30 the transition-time interval.

1 14. (Original) A controller for moving an element that is part of a system during a transition-
2 time interval, to achieve a selected optimization criterion, comprising:

3 (a) a memory in which machine instructions are stored; and
4 (b) a processor that is coupled to the memory, said processor executing the
5 machine instructions to carry out a plurality of functions, including:

6 (i) accessing a model of the system;
7 (ii) using the model for characterizing internal dynamics of the system in
8 which energy applied to the system outside the transition-time interval is hidden so that the element
9 will not move other than during the transition-time interval;

10 (iii) for the selected optimization criterion, determining optimal internal
11 states at a beginning and an end of a movement of the element between the first position and the
12 second position; and

13 (iv) based upon the optimal internal states, determining an optimal control
14 input signal for a transition-interval input and at least one of a pre-actuation input and a
15 post-actuation input acting on the system to cause the element to move from the first position to the
16 second position so as to achieve the selected optimization criterion, wherein the pre-actuation input
17 applies energy to the system before the transition-time interval, the post-actuation input applies
18 energy to the system after the transition-time interval, and the transition-interval input applies energy
19 to the system during the transition-time interval.

20 15. (Original) The controller of Claim 14, wherein the selected optimization criterion used
21 causes the element to move between the first position and the second position with substantially a
22 minimum input energy.

23 16. (Original) The controller of Claim 14, wherein the selected optimization criterion used
24 causes the element to move between the first position and the second position in substantially a
25 minimum time.

26 17. (Original) The controller of Claim 14, wherein the pre-actuation input is uniquely
27 specified in terms of an unstable internal state component.

28 18. (Original) The controller of Claim 17, wherein the post-actuation input is uniquely
29 specified in terms of a stable internal state component, and wherein the unstable internal state
30 component and the stable internal state component are the only components of boundary states for the

1 first position and the second position that can be varied by the controller to ensure that the element
2 does not move as a result of the energy applied to the system other than during the transition-time.

3 19. (Original) The controller of Claim 14, wherein the control input signal is defined as a
4 function of a transition state difference related to the difference between the first position and the
5 second position.

6 20. (Original) The controller of Claim 14, wherein at least one of the pre-actuation input, the
7 post-actuation input, and the transition-interval input comprises a periodically varying signal at one
8 or more frequencies selected to act on the element without causing the element to move prior to and
9 after the predefined interval of time.

10 21. (Currently Amended) The controller of Claim 14, wherein to move the element during
11 the transition-time interval, the machine instructions further cause the processor to apply ~~an~~ the
12 transition-interval input signal ~~to move the element~~ during the transition-time interval, as well as
13 applying the post-actuation input after the transition-time interval, but not applying the pre-actuation
14 input before the transition-time interval.

15 22. (Currently Amended) The controller of Claim 14, wherein to move the element during
16 the transition-time interval, the machine instructions further cause the processor to apply ~~an~~ the
17 transition-interval input signal ~~to move the element~~ during the transition-time interval, as well as
18 applying the pre-actuation input before the transition-time interval, but not applying the
19 post-actuation input after the transition-time interval.

20 23. (Currently Amended) The controller of Claim 14, wherein the processor produces an
21 output signal adapted to drive a read/write head of a nonvolatile memory device that is moved
22 between the first position and the second position to provide access to different portions of a memory
23 medium.

24 24. (Original) The controller of Claim 14, wherein the processor is adapted to produce a
25 non-linear output signal.

26 25. (Original) The controller of Claim 14, wherein a control function implemented by the
27 controller comprises one of:

- 28 (a) scanning a surface;
29 (b) reading data;
30 (c) writing data;

1 (d) positioning an element to implement a process;
2 (e) positioning an element to access a desired material;
3 (f) controlling a process;
4 (g) fabricating a component; and
5 (h) controlling operation of a system in which the element is moved from
6 time-to-time.

7 26. (Original) A method for moving an element that is part of a system, between a first
8 position and a second position during a transition-time interval, to achieve at least one of a minimum
9 transition-time interval and a minimum energy for moving the element between the first position and
10 the second position, comprising the steps of:

11 (a) determining a relative degree of the system;
12 (b) finding an inverse input for the system;
13 (c) selecting a transformation matrix to convert system equations that define the
14 system, into an output tracking form;
15 (d) transforming the system equations into the output tracking form;
16 (e) decoupling internal dynamics of the system to produce decoupled internal
17 dynamics;
18 (f) computing parameters for the decoupled internal dynamics; and
19 (g) determining an optimal output-transition solution as a function of the
20 parameters, for defining an optimal control input for adding at least one of a pre-actuation energy and
21 a post-actuation energy to the element, without causing movement of the element other than during
22 the transition-time interval.